

# **BUCK ISLAND REEF NATIONAL MONUMENT**

## ***GEOLOGIC RESOURCE MANAGEMENT ISSUES SCOPING SUMMARY***



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## TABLE OF CONTENTS

INTRODUCTION.....	3
BUIS MAPPING PRODUCTS .....	3
GEOLOGY OF BUCK ISLAND REEF NATIONAL MONUMENT.....	6
SIGNIFICANT MANAGEMENT ISSUES.....	6
<i>1.Coastal and Marine Features and Processes.....</i>	<i>6</i>
<i>2.Recreational Impacts .....</i>	<i>7</i>
<i>3.Windblown Features and Processes.....</i>	<i>7</i>
<i>4. Seismic Activity .....</i>	<i>7</i>
SCOPING MEETING PARTICIPANTS .....	8
REFERENCES.....	8

## **EXECUTIVE SUMMARY**

A Geologic Resources Evaluation scoping meeting was held for Buck Island Reef National Monument (BUIS) on April 5, 2004. The scoping meeting participants identified the following as the most significant geologic resources management issues:

1. Inventory and monitor coastal and marine processes and resources such as sediment transport, sediment thickness, coral reef populations (i.e. health, location, species), and other benthic habitats.
2. Monitor BUIS hiking trails for a significant increase in erosion.
3. Investigate the possible effects of windblown particulates (i.e. Saharan dust, Montserrat dust) on park resources.
4. Monitor seismic activity in the Puerto Rico Trench and the Anegada Trough for earthquakes and tsunamis.

## **INTRODUCTION**

The National Park Service conducted a Geologic Resources Evaluation scoping meeting at Buck Island Reef National Monument on April 5, 2004. The purpose of the meeting was to discuss the status of geologic mapping in the park, the associated bibliography, and the geologic issues in the park. The products to be derived from the scoping meeting are: (1) Digitized geologic maps covering the park; (2) An updated and verified bibliography; (3) Scoping summary; and (4) A Geologic Resource Evaluation Report which brings together all of these products.

Buck Island was originally designated a protected area by the Municipal Government of St. Croix in 1948. In 1961, Buck Island Reef National Monument was established by President Kennedy in order to protect and preserve "one of the finest marine gardens in the Caribbean Sea." The park included the 176- acre island and approximately 700 acres of submerged lands. In 2001, President Clinton expanded the park to include an additional 18,135 acres of submerged resources. To date, the park contains a total of 19,015 acres (FY2005).

## **BUIS MAPPING PRODUCTS**

Buck Island Reef National Monument has "quadrangles of interest" (or "QOI's") at the 7.5'x7.5' - (1:24,000) scale. It is desired to obtain DIGITAL geologic map coverage for all identified 7.5' qoi's. (Figures 1,2 and 3).

While numerous "paper" maps at suitable scale have been published for this park, complete DIGITAL geologic map coverage is not available. It is hoped that through the

scoping meetings and discussions with park staff , the USGS and state geological surveys that gaps in DIGITAL coverage can be resolved for areas not currently known to have digitized geologic maps. These meetings lay the foundation for a plan to accomplish this task

The contents of this document reflect what is known regarding published geology as of September 6, 2005, from searches done by NPS-GRD staff as discerned from the USGS on-line geologic maps database found at:

[http://ngmdb.usgs.gov/ngmdb/ngm\\_compsearch.html](http://ngmdb.usgs.gov/ngmdb/ngm_compsearch.html)

In short, it appears a few maps do give coverage for the island of Saint Croix as follows:

- NOAA Benthic Habitats map
- Whetten, J.T., 1966, Geology of St. Croix, U.S. Virgin Islands, Geological Society of America, Memoir 98, 1:31,680 scale

During the scoping sessions held in April 2004, for Buck Island Reef National Monument (BUIS), Salt River Bay National Historical Park and Ecological Preserve (SARI) and Christiansted National Historic Site (CHRI), it was decided that the Whetten map would be the best available source to give the bedrock geology of the island of Saint Croix, as it would also encompass all three NPS areas on the island of St. Croix (Figures 1 and 2) . NPS-GRE staff will acquire the original map and convert it into a digital, user-friendly GIS product.

The NOAA benthic habitat maps will accompany the bedrock map of the island and is already available digitally. NPS-GRE staff will incorporate it as well into a final geologic map of the island. A summary table follows along with explanatory graphics.

Extent of Coverage	Published Map Citation	Paper	Digital	GRE Plan
Entire island of Saint Croix	Whetten, J.T., 1966, Geology of St. Croix, U.S. Virgin Islands, Geological Society of America, Memoir 98, 1:31680 scale	yes	Unknown	Acquire paper copy and convert to digital
Entire island of Saint Croix	Kendall, M.S., M.E. Monaco, K.R. Buja, J.D. Christensen, C.R. Kruer, and M. Finkbeiner, R.A. Warner, 1999, Benthic Habitat Maps of the U.S. Virgin Islands- St. Croix; Prepared by Visual Interpretation from Remote Sensing Imagery Collected by NOAA in 1999, 1:6000 scale	Unknown	Yes, from NOAA	Convert NOAA digital version to NPS format

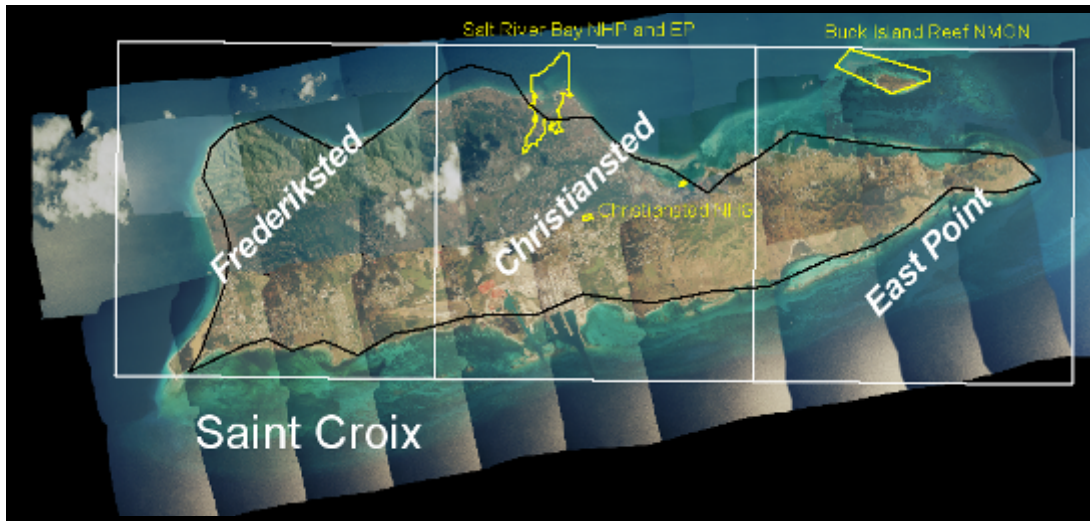


Figure 1: Quadrangles of Interest (QOI's) for BUIS, SARI, and CHRI (7.5' shown in white outline; park boundaries in yellow outline; MrSID image of Island of Saint Croix as background).

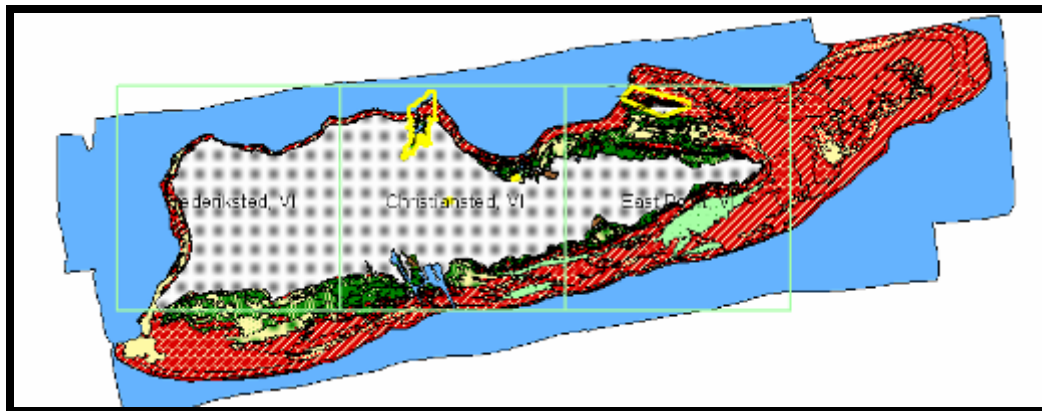


Figure 2: NOAA Benthic Habitats of Saint Croix Island

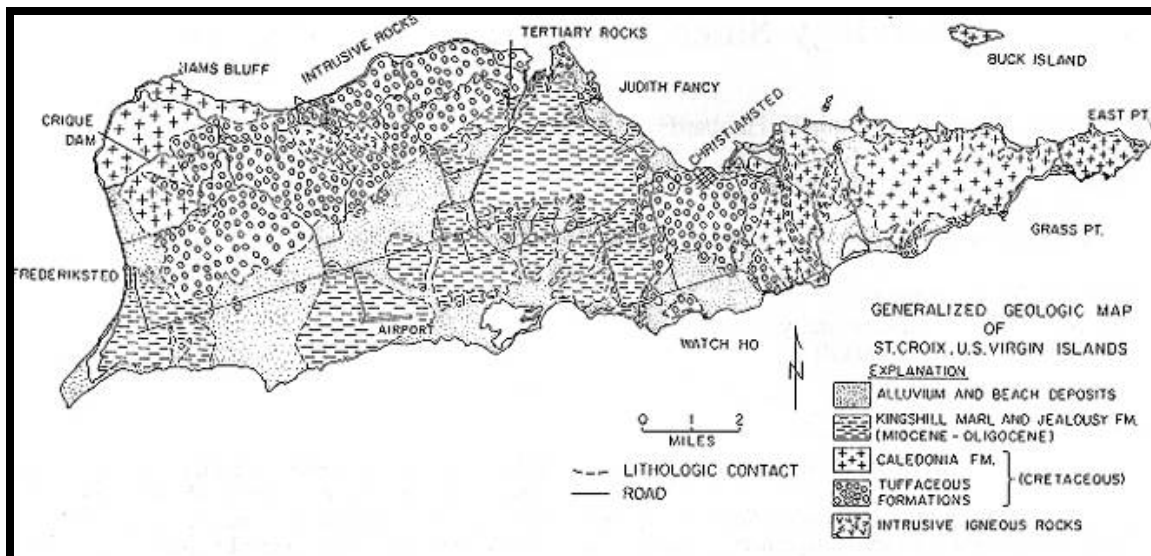


Figure 3: Scan of Generalized Geologic Map of Saint Croix (after Whetten 1974, in Hubbard SP8)

## **GEOLOGY OF BUCK ISLAND REEF NATIONAL MONUMENT**

Taken from Bythell et al., 1989

Buck Island Reef National Monument lies approximately 2 km north of St. Croix. The park's modern carbonate environment is composed primarily of the elkhorn coral, *Acropora palmata*. The only non-carbonate exposures are found in a narrow band of Caledonia Formation volcanoclastics (~100 my). This band rings the island and is exposed on the entire shoreline of BUIS with the exception of the west shore. Holocene beachrock also fringes much of the island. (Whetten, 1966; Bythell et al. 1989)

The east end of Buck Island is encompassed by a massive bank barrier reef that encloses a 200-300 m. wide, and 2-4 m deep, lagoon. This bank-barrier reef trends from southeast to the northwest and represents one of the largest stands of elkhorn coral on St. Croix. The north side of the island is dominated by isolated patch reefs, both within the lagoon and seaward of the bank barrier reef. The seaward patch reefs, known as haystacks, are composed of almost 100% dead *Acropora palmata*.

Although many of the corals found at BUIS have been decimated by White Band disease, living stands of corals on the windward reefs may grow at the high rate of ~15 meters per 1000 years. This high growth rate, combined with high population densities, result in high levels of carbonate production for Buck Island Reef National Monument. (Gladfelter et al., 1977; Gladfelter and Gladfelter, 1979; Bythell et al., 1989)

## **SIGNIFICANT MANAGEMENT ISSUES**

The scoping participants identified the following as the most significant geologic issues at Buck Island Reef National Monument:

### ***1. Coastal and Marine Features and Processes***

1. Sediment characteristics – sediment thickness, type, and grain size should be integrated into park maps. Available information on sediment distribution, budget, and sources and sinks should be available to park managers for a variety of reasons including, but not limited to, buoy placement and maintenance, boat anchoring, and erosion hotspots. An understanding of the system's sediment supply is critical for monitoring coastal areas and predicting shoreline change.
2. Boating Hazards – boat anchoring and vessel groundings may damage coral reefs. Although anchoring is permissible in certain areas, illegal anchoring and anchor dragging may destroy marine habitat throughout the park. In addition, vessel groundings due to inexperienced boating and storm events may critically damage large sections of coral reefs.
3. Oceanographic Variables – relative sea level rise, temperature and salinity patterns, currents, and tidal regimes should be monitored for Buck Island Reef

National Monument. These variables may aid in identifying sediment transport patterns within the park. In addition, knowledge of currents at headlands and in channels may reduce visitor injuries.

4. Benthic habitat mapping – Buck Island Reef National Monument is working in cooperation with NOAA to complete benthic habitat mapping for the park. Benthic habitats including coral reefs and submerged aquatic vegetation will be included in coastal mapping products. These features influence the hydrodynamic regimes within their localized areas, thereby determining sedimentation patterns. The location of marine habitats should be known in order to determine the impacts that coastal development and visitor use may have on their health and survival.

## ***2. Recreational Impacts***

Buck Island Reef National Monument is experiencing significant erosion on its hiking trails. Further studies are needed because even small increases in sedimentation can negatively affect adjacent marine habitats including coral reefs and seagrass beds.

## ***3. Windblown Features and Processes***

Currently, the park is investigating the effects of Saharan dust on park resources. It is believed that imported particulates could have harmful effects on fragile marine habitats such as coral reefs and seagrass beds, by carrying fungi and dust-borne pathogens. Dust from alternate sources such as the Montserrat eruption of 1995 could also have negative impacts on park resources.

## ***4. Seismic Activity***

The Virgin Islands are situated on an active plate boundary zone between the Caribbean Plate and the North American Plate. Periodic seismic activity, including earthquakes, submarine landslides, submarine volcanic eruptions, subaerial pyroclastic flows, and tsunamis are common throughout the region. The active fault zone lies approximately 100 miles north of Buck Island Reef National Monument in the Puerto Rico Trench. (Olcott, 1999) In addition, the Anegada Trough lies between St. Thomas and St. Croix. In 1867, a 7.5 magnitude earthquake generated two large tsunamis. These tsunamis produced waves in excess of 23 feet, causing loss of life and structural damage on St. Croix.

Currently, A U.S. Geological Survey (USGS) seismic station in Puerto Rico monitors earthquake activity in the U.S. Virgin Islands.

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